

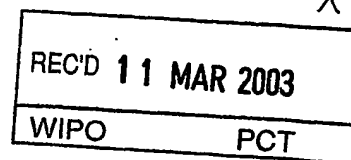


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Projection device having a mode selection unit

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Projection device having a mode selection unit

The invention relates to a projection device for projecting an image comprising a light source, electro optical light modulation means and image projection means for projecting the image. The invention relates further to a corresponding method of projecting an image.

5 Projection devices, in particular LCD projection devices, are becoming more and more popular for business presentations, particularly for presentation of graphic and/or PC data. However, due to the high price, the market of those projection devices for home video applications is still moderate. JP 07 084 553 A therefore proposes a projection liquid crystal display device which is capable of obtaining excellent contrast or luminance in
10 accordance with each picture display and of obtaining excellent display picture quality even in the case of displaying a video or a PC picture. Therein, the diameter of an aperture which is located in the imaging path in front of a projection lens is controlled by a mode selection circuit. In case of displaying video data, the diameter of the aperture is made small improving the contrast, while in case of displaying a PC picture the diameter of the aperture is made
15 large enhancing the brightness.

It is an object of the present invention to provide an alternative solution for a projection device which can be used and is optimised for at least two different modes and which avoids the need of controlling an aperture in the imaging path.

This object is achieved according to the present invention by a projection
20 device as claimed in claim 1 which, in addition to the light source, the electro-optical light modulation means and the image projection means, further comprises a integrator module comprising at least a first submodule and a mode selection unit for controlling said module such that said first submodule is active in the light path from said light source to said image projection means or not, said first submodule being adapted for improvement of centre
25 brightness and white point of the light.

Contrary to the known solution the switchable module is not located in the imaging path within the image projection means or between the image projection means and a screen, but is located in the illumination path so that the light will already be influenced and optimised before it reaches the image projection means. In this way a much better

optimisation depending on the type of data (Video, PC) to be converted into an image for projection can be achieved. The first submodule provided according to the present invention is optimised for video applications which require a proper white point to obtain true colours, e.g. correct skin tones. Further, the perceived picture quality for video applications is improved when there is more light in the centre of the screen with respect to the corners. If, instead of video data, graphic or PC data shall be projected, the first submodule can simply be made inactive by the mode selection unit, e.g. by moving the first submodule out of the light beam. The present invention thus provides a cheap but very effective solution of a projection device which is usable and optimised for different kinds of applications.

10 In contrast a light-distribution over the image provided by the solution known from JP 07084553 A is not optimised for these two different applications. In the projection device known therefrom only the contrast of the projected image can be improved by preventing light-raise that traverse through the LCD panels at angles where the contrast is weak to hit the screen. This is achieved by reducing the size of a diaphragm, but this causes a
15 loss of light, leading to lower brightness.

In contrast, the present solution does not focus on contrast optimisation, but on light-distribution over the image. In case of a data projection a very homogeneous light-distribution is required, i.e. the corner brightness needs to be almost similar as the centre brightness. For these images the white colour is of lesser importance. Thus, what this kind of application the best picture performance is provided, i.e. a homogeneous illumination with good colour brightness and minimum light loss for colour generation.

20 In case of video projection a different light-distribution is preferred. For these applications the human eye likes the pictures more when the centre brightness is peaked. This is achieved according to the present invention by another integrator module that distributes the light in another manner over the image. Compared to the data mode now light is taken away from the corner and brought to the centre. Next, for video, the human eye is very sensitive for proper colours (especially in skin colours). This is achieved in this mode with an extra filter element that balances the colour channels and thus the white point.

30 Compared to the solution known from JP 07084553 A the present solution has the advantage that in both cases the best brightness is achieved. Colour balancing has a further advantage. If the colour balancing is achieved by modifying the voltages to the LCD panels this balancing is influencing the contrast in the image. LCD projection systems have a limited contrast due to light-leakage of the panels, and this light-leakage remains identical when the voltages to the panels are modified for proper colour balancing, e.g. if the green

channel needs to be dimmed with 40% this would also mean a 40% lower contrast in the projected image (maximum brightness becomes 40% less, and dark sate remains identical). In case of the colour filter, both the bright sate and the dark sate are dimmed and the contrast is not changed.

5 Preferred embodiments of the invention are defined in the dependent claims. According to a first embodiment the module is located between the light source and the light modulation means.

According to another preferred embodiment the first submodule comprises an integrator module or a lens unit, particularly comprising two lenses or improving centre
10 brightness and providing a better video performance.

It is further preferred that the first submodule comprises colour balancing filter means for balancing the light spectrum towards the required colour coordinates, particularly for video applications for adjusting a proper white point.

Instead of simply making the first submodule inactive in case that no video
15 application is required, the module further comprises a second submodule according to another preferred embodiment of the invention, which second submodule is adapted for improving corner brightness and intensity of light output. The mode selection unit is then adapted for controlling the module such that either the first or the second submodule is active in the light path. The second submodule is thus optimised for business applications, i.e. for
20 projection of graphic or PC data. This application requires a very homogeneous brightness over the entire image (high corner brightness) and a maximum light output while a proper colour balancing is not required.

It is advantageous that the mode selection unit is adapted for automatically controlling the module based on the type of data to be converted into an image for projection.
25 In this way the module switches automatically in the correct mode depending on the type of input data. It is thus preferred that for video data the first submodule is active while for graphic and/or PC data the second submodule is active since the submodules are optimised for the corresponding applications.

Alternatively or in addition a user interface can be provided for control of the
30 mode selection unit by a user who may then be able to select the correct mode.

The invention can be generally applied in any kind of projection device. A preferred application are LCD projection devices where the electro-optical light modulation means comprise a three-panel liquid crystal display as particularly described in WO
01/19092.

The invention will now be explained more in detail with reference to the drawings, in which

Fig. 1 shows a first embodiment of a protection device according to the

5 invention and

Fig. 2 shows a second embodiment of a protection device according to the present invention.

The protection device according to the invention shown in fig. 1 comprises a

10 light source 1, i.e. a protection lamp, such as an ultra high pressure (UHP) lamp, having a curved reflector, electro-optical light modulation means 22 and a projection lens 12. The electro optical light modulation means 22 comprise three electro-optical light modulation panels 4, 5, 6 with which a green (G), a red (R) and a blue (B) part, respectively, of an image to be projected is realized. Further, lenses 9 and (dichroic) folding mirrors 10 are

15 provided in said light modulation means 22 which are known per se and will therefore not be described in the later detail. Moreover, the light modulation means comprise a dichroic prism 23 arranged between the light modulation panels 4, 5, 6 and the projection lens 12. Regarding more details of such a projection device reference is made to WO 01/19092.

For driving the Light modulation means 22 a projection drive unit 19 for

20 providing it with the information about the images to be projected is provided. The data D, such as video, graphic or PC data, are therefore inputted into the projection drive unit 19.

According to the present invention there is further provided between the light source 1 and the light modulation means M in the illumination path a switchable module 3 comprising a first submodule 31 and a second submodule 32. Depending on the type of

25 application either one of said submodules 31, 32 is active in the illumination path while the other one is inactive. Said activity is controlled by a mode selection unit 20 which is connected to the projection drive unit 19 from which it receives an information about the kind of data D and/or the kind of application so that the correct submodule 31 or 32 can be made active. In addition or alternatively a user interface 21 can be provided for allowing a

30 user to switch between the first or the second submodule 31 or 32 via the mode selection 20.

The first submodule 31 comprises two (in general one or more) lenses 34 and a spectral filter 33 for white balancing. It is optimised for video applications which generally require a proper white point to obtain true colours. Since the projection lamp 21 usually has a shortage for blue and red light the white point of the light emitted by the projection lamp is

clearly visible shifted to green. To correct for this in case of video applications the first submodule contains the filter element 33 that balances the light spectrum towards the proper colour coordinates and to adjust the correct white point. Further, it comprises the lenses 34 for improving the perceived picture quality by focussing more light on the centre of the display with respect to the corners, i.e. the corner brightness is reduced as compared to other applications.

The second submodule 32 comprises two lens plates 35 each carrying a number of lens elements. It is optimised for business applications, such as the projection of graphic or PC data. In such applications a high corner brightness and a maximum light output is required. To maximize the brightness no light is "wasted" for proper colour balancing.

Further elements like additional lenses, integrators and/or a polarizing beam splitter also be provided but are not shown.

By the mode selection unit 20 either one of said submodules 31, 32 can be made active, e.g. by moving one of said submodules in the lightpath and moving the other submodule out of the lightpath.

In the embodiment shown in Fig. 2 the submodule 31 comprises, instead of the two lenses 34, video integrator modules 36 comprising a lens plate carrying several lenses.

It shall be noted that according to alternative embodiments of the invention the module 3 could only comprise the first submodule 31 which is made active for video applications while for other applications the first submodule 31 is simply moved out of the light beam so that the light beam is not influenced at this point. According to still another embodiment the module 3 could also be located at another position within the projection device. Still further, the invention can generally also be applied in other projection devices, particularly comprising different light modulation means.

CLAIMS:

1. Projection device for projecting an image, comprising:

- a light source,
- electro-optical light modulation means,
- image projection means for projecting the image,
- 5 – a switchable module comprising at least a first submodule, and
- a mode selection unit for controlling said module such that said first submodule is active in the light path from said light source to said image projection means or not, said first submodule being adapted for improvement of centre brightness and white point of the light.

10

2. Projection device as claimed in claim 1, wherein said module is located between said light source and said light modulation means.

3. Projection device as claimed in claim 1, wherein said module first, comprises
15 an integrator module or submodule a lens unit, particularly comprising two lenses.

4. Projection device as claimed in claim 1, wherein said first submodule comprises colour balancing filter means for balancing the light spectrum towards the required colour coordinates.

20

5. Projection device as claimed in claim 1, wherein said module further comprises a second submodule adapted for improving corner brightness and intensity of light output, and wherein said mode selection unit is adapted for controlling said module such that either said
25 first or said second submodule is active in the light path.

6. Projection device as claimed in claim 1, wherein said mode selection unit is adapted for automatically controlling said module based on the type of data to be converted into an image for projection.

7. Projection device as claimed in claim 6, wherein said mode selection unit is adapted such that for video data said first submodule is active in the light path and that for graphic and/or PC data said second submodule is active.

5

8. Projection device as claimed in claim 1, further comprising a user interface for control of said mode selection unit by a user.

9. Projection device as claimed in claim 1, wherein said electro-optical light

~~10 modulation means comprise a three-panel liquid crystal display.~~

10. Method of projecting an image, comprising the steps of:

- generating light by a light source,
- improving the centre brightness and white point of the light by a first submodule,
- 15 - controlling activity of said first submodule in the light path by a mode selection unit,
- modulating the light by an electro-optical light modulation means,
- projecting the image by an image projection means.

ABSTRACT:

The invention relates to a projection device for projecting an image comprising a light source (1), electro-optical light modulation means (22) and image projection means (12) for projecting the image. In order to provide a projection device that can be used and is optimised for different modes, such as for video applications and business applications, the projection device according to the present invention further comprises a switchable module (3) comprising at least a first submodule (31) and a mode selection unit (20) for controlling said module (3) such that said first submodule (31) is active in the lightpath from said light source (1) to said image projection means (12) or not, said first submodule (31) being adapted for improvement of centre brightness and white point of the light.

Fig. 1

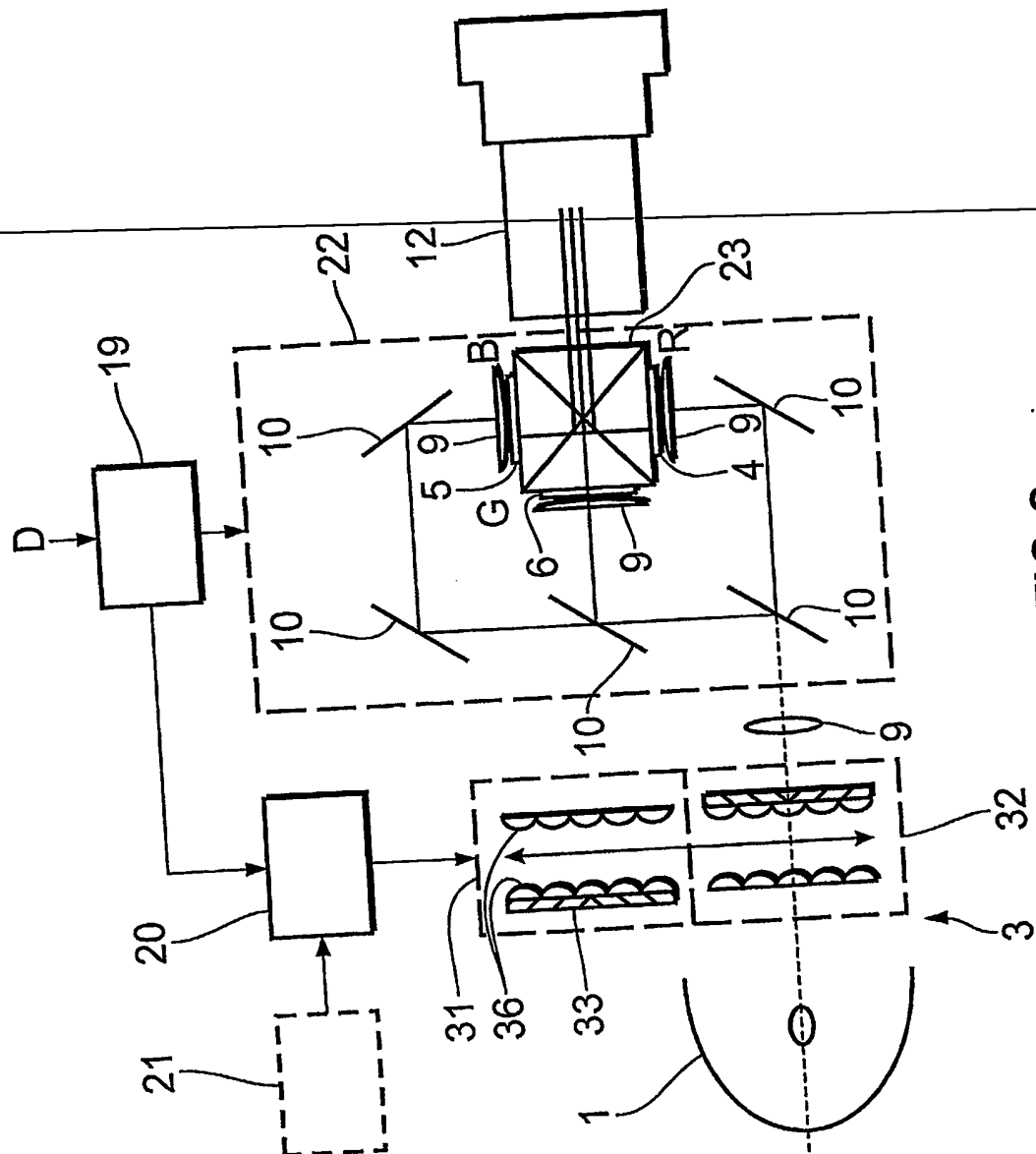


FIG.2

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